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COURTSHIP AND OVIPOSITION PATTERNS OF TWO *AGATHYMUS* (MEGATHYMIDAE)

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ABSTRACT. Males of *Agathymus estelleae* take courtship sentry positions near teneral virgin females long before the females are ready to mate. Males of *Agathymus mariae* are territorial and pursue virgin females that approach their territories. Oviposition patterns of the two species are very similar. Females alight on or near the plants to oviposit and do not drop ova in flight.

Few detailed observations of the courtship and oviposition of the skipper butterflies in natural environments have been published. For the family Megathymidae Freeman (1951), Roever (1965) (and see Toliver, 1968) described mating and oviposition of some Southwestern U.S. *Agathymus*, and over a hundred years ago (1876) Riley published an excellent paper on the life history of *Megathymus yuccae* (Boisduval & LeConte) which included data on oviposition of the female; otherwise, only the scantiest comments have been made. C. L. Remington (pers. comm.) and others tell us that there is a significant possibility that the Hesperioidea are less closely related to the true butterflies (Papilionoidea) than to certain other Lepidoptera and even that the Megathymidae may not be phylogenetically linked to the Hesperiidae. For several years we have been making on-the-scene studies of these two aspects of megathymid behavior, both for their interest in understanding the whole ecology of these insects and for their possible reflection on higher relationships. In this first paper we are presenting our findings for two close relatives in the genus *Agathymus*.

In 1976 the four of us took advantage of an opportunity to watch a number of courtship sequences of *Agathymus estelleae* (Stallings & Turner) and their pattern of ovipositing. Most of these observations were made on 7, 8, 12, and 14 September, 16.5 km north of Saltillo, Coahuila, Mexico on Highway 57 at an elevation of approximately 1380 m. The females emerged from 0800 to 0930 h (CDT) and in the wild, crawled up on a leaf of their food plant as their wings expanded and hardened. Shortly after the females commenced to emerge, males appeared and flew by the female, often as close as 30 cm. The first male to locate a female would then perch on a leaf of the food plant, *Agave lecheguilla* Torr., or on a stone or small shrub about 8 m or less

downwind from the female; other males would fly by the female and would be pursued by the first male, who would chase them out of his "territory." The sentry site of the first male appeared to be rather small, as subsequent males would take up positions downwind from the female as close as 5 m from the first male. There tended to be three males in attendance by the time of the maiden flight. Butterflies would fly through the area and would not be pursued by the males except for dark skippers with white fringes, which the males evidently mistook for other *estelleae*. After the female's wings had expanded fully, she would rest on the leaf with her wings folded so that the apex of the forewings touched. The males, on the other hand, rested with their forewings apart, and their hindwings dropped down almost perpendicular with their body. We called this the male launching position, as they were able to take off in full flight immediately.

Two to three hours after a female emerged she would make her maiden flight, which seemed a long period to us. She would rise from her resting position in a circular flight and fly downwind very rapidly in an undulating manner some 2 to 5 m above the ground. In nearly every instance she flew directly over the male who had been first to establish a sentry position. The first male would rise above and just behind to meet her as she flew over his position dipping down towards her so that he appeared to touch her. She would quickly drop down to or near a food plant, followed closely by the male. All of this happened within a few seconds, in which the female had not traveled over 40 m from her original resting site. If there were other males watching the female, they joined in the pursuit of her. Usually as the female and first male came to rest, they were in copulation within 3 or 4 sec. If there were other males they would alight by the female and try to mate with her. If none of the males had succeeded in mating with her in about 7 sec, she would fly off in a straight line pursued by all of the males. We were never successful in observing what happened when she came to rest a second time. On three occasions, if the first male was successful in mating, the other males flew away but returned within 5 to 10 sec and alighted within 15 to 20 cm of the copulating pair. Within a few seconds the unsuccessful males again flew away and then returned within 5 to 10 sec but would alight 60 to 100 cm from the copulating pair. Again, the unsuccessful males would fly away and return shortly, this time alighting about 2 m away from the pair. After a final brief inspection, the unsuccessful males would fly away and not return. The mating pair would remain in copulation from 66 min to five hours. We had no difficulty in moving them into a wire cage, so that we could recover the ova to be laid later. On two occasions we happened to flush virgin females before they were ready to mate. Their

flight was in a straight line to another plant or bush, and although there were males around, none of them pursued these females.

On 7 September a pair was found in copulo at about 1430 h, clinging to the underside of a *lecheguilla* leaf; when they flew away, the female appeared to be flying and the male dangling. This copulation had presumably started much earlier, because four observed couplings took place at 1050, 1118, 1120, and 1155 h.

While vision is undoubtedly a major part of the courtship process, we assume that the female emits a pheromone shortly before or as she makes her pre-mating flight. On one morning the wind shifted after a male had established his sentry position. We noted with interest that he maintained his position even though he was then upwind from the female. When the female took off on her mating flight she flew downwind, with the result that the first male was an unsuccessful suitor, because a downwind male reached her before he did.

One observation day was very hot, and from noon until 1600 h we saw no flight activity among the *estelleae,* although there were other butterflies flying in the area. Shortly after 1600 h some scattered clouds appeared along with some female *estelleae.* Each of the females proceeded to oviposit by alighting on a leaf of the food plant with wings completely closed and then dropped an ovum that fell to the base of the plant where it might lodge among the leaves or bounce out on the ground. This took from four to seven seconds. We were wondering why the first females did not drop more than one ovum at a time, when we were accommodated by a female which proceeded to drop five to seven ova at one location, without flying. A few days later we again watched females lay as many as five ova in one sitting. We noted that after a female dropped five to 10 single or multiple ova she would alight on a rock or bush and rest before proceeding with her ovipositing. Since in many years of field work we had seldom found larvae in juvenile plants or plants located in the shade of a bush or rock, we had always supposed that the females were very selective as to where they placed their ova. However, we were in error, as the females were indiscriminate as to the size or location of the plants where they dropped their ova. We suspect that there are more predators in the juvenile plants or plants under bushes and that the ova or the small larvae had a lesser chance to survive there.

At about 1630 h the cloud cover usually became heavier, and the temperature dropped slightly. Various butterflies in the vicinity sought shelter, but the *estelleae* females continued their activities. Once a slight breeze came up, and we could smell moisture. Evidently, the *estelleae* recognized the oncoming shower, for they immediately sought shelter in plants and bushes and on the downwind side of small rocks.

A minute or two later it began to rain, and it was evident that several of the females had not picked a good site for shelter as they commenced flying about seeking a more sheltered area.

One of the females that we kept for ova count produced 95 ova the first day, 23 the second day, 10 the third day, 23 the fourth day, 4 the fifth day, 14 on the sixth day, and 8 on the seventh day; when she died she had 3 ova left in her body for a total of 180 ova. Ova of this species vary in color from green through a sand color; all of those laid on the last two days by this female were green.

Two of the authors (DBS and VNTS) conducted a series of observations 5 and 6 October 1983 in the Guadalupe Mountains near Carlsbad, New Mexico for the purposes of determining the courtship and ovipositing patterns of *Agathymus mariae* (Barnes & Benjamin), a species rather closely related to *A. estelleae*.

Females emerged from their pupae from 0900 to 1030 h (MST). The males emerged some 30 min earlier than the females. A newly emerged female would crawl up a leaf of the plant on its inner side, approximately one-third of the distance from the tip of the leaf. It took about 2 to 3 hours for the wings to expand and harden.

Males that had emerged the prior day or earlier patrol the area around the food plants (*Agave lecheguilla*). Males that emerged earlier in the day eventually join in the patrol. The patrolling on the part of the males consists of flying back and forth over the food plants. It is interrupted by the males alighting on small rocks or directly on the ground in an open area where they can see and be seen; they would remain there from 1 to 10 min and then resume their patrol. The patrol flight was usually within 1 m of the ground. As they repeated their patrol and alighting procedure, they would sometimes alight on the ground, where they had been, and at other times would alight in a new area. The selection by a male of a new area within which to alight may be dictated by the failure of a female to fly over the previously selected site. In defending territory a male would pursue another male who entered his territory. They would often fly 6 to 10 m up into the air.

Males would often fly by a teneral female within 30 to 40 cm without any indication that they recognized her presence.

It appears that *mariae* males alight in an open area and depend on a female finding them by flying over them. This is in contrast to *estelleae* where the male establishes a sentry position in relation to a specific female which he will pursue when she makes her first flight. Thus, while *estelleae* and *mariae* have different courtship patterns, the males of each establish a position during the courtship period of each day and defend it against other males.

We noted a number of day-flying saturniid moths (*Pseudohazis*) flying about, which we sometimes mistook for an *Agathymus*, but the male *mariae* evidently had no such difficulty.

Around noon a female would take off on her first flight. She would circle in a fluttering manner around the area where she had been resting. Her flight was usually not over 70 cm above the ground, and the radius of the circle was about 8 or 9 m. This circle nearly always covered an area that would have at least one male temporarily on the ground. When the male sighted the female, he would take off in pursuit of her. As the male approached the female, she would drop to the ground, alighting on a rock or a leaf of the food plant where he would join her; within 5 sec they would be in copulation. The duration of copulation varied from 48 min to several hours.

After copulation the fertilized female would remain at rest until 1600 or 1700 h, at which time she would commence ovipositing. We think the period of day when females oviposit is determined by temperature, because captive females in protected areas where the temperature was less than in more exposed areas would commence ovipositing shortly after mating. A female would fly in a fluttering manner to a food plant where she would alight on one of the outer leaves and drop an ovum. Some females dropped a single ovum while others dropped two ova. We suspect that some females drop more than two ova at a single stop, although we did not observe any doing this.

Since the females that we observed alighted on the outer leaves of the food plant, all of the ova fell on the ground. We were able to recover ova that we saw laid. The female would usually take a short rest after depositing 3 to 5 ova.

The three couplings that we observed occurred at noontime, specifically at 1155, 1210 and 1242 h.

Our observations of *Agathymus carlsbadensis* (Stallings & Turner) in this same general area of the Guadalupe Mountains was inconclusive. We think the courtship pattern is very similar to that of *A. mariae*. The ovipositing pattern appears to be entirely different. We never did observe a female alighting on a plant to oviposit. At least five different times we observed females hovering over or near their food plant. We suspect that they were ovipositing from this hovering position, but we were unable to recover any ova.

In the 1940's we corresponded with W. P. Medlar, a collector in California who advised us that he had observed *Agathymus stephensi* (Skinner) ovipositing. According to him the female hovered over or near the food plant and flipped the ova towards the plant. Freeman reported the same thing in 1951 for *Agathymus aryxna* (Dyar) and *Agathymus evansi* (Freeman). In 1951 when Freeman's paper was

published the name *neumoegeni* was being mistakenly applied to *aryxna*. He followed this mistake. Correspondence that we received from Freeman at the time of his observations mention only *evansi* as ovipositing from a hovering position; no mention was made of *aryxna*. Roever (1965) reported that he had not observed females flipping their ova into the plant while hovering over or near a plant; however, he noted that both of the species alight on or near the plant when ovipositing. He reported that he had observed ovipositing by the female while on or near a food plant. He made the same observations for *Agathymus neumoegeni* (Edwards), *A. polingi* (Skinner), *A. baueri* (Stallings & Turner), *A. freemani* (Stallings & Turner). It is evident that more observations are needed in order to reconcile these divergent reports.

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LITERATURE CITED

FREEMAN, H. A. 1951. Notes on the Agave feeders of the genus *Megathymus*. Field & Laboratory 19:26–32.

RILEY, CHARLES V. 1876. The yucca borer.—*Megathymus yuccae* (Walker). Eighth Ann. Rept. Noxious, Beneficial and Other Insects of the Station of Missouri, pp. 169–182.

ROEVER, KILIAN. 1965. Bionomics of *Agathymus*. J. Res. Lepid. 3:103–120.

TOLLIVER, MICHAEL. 1968. Apparent partial courtship between *Megathymus yuccae coloradensis* and *M. streckeri* (Megathymidae). J. Lepid. Soc. 22:177–178.